Worm-like propagation of Sysrv-hello crypto-jacking botnet: Network traffic analysis and latest TTPs

darktrace.com/blog/worm-like-propagation-of-sysrv-hello-crypto-jacking-botnet

26

May 2022

26

May 2022

In recent years, the prevalence of crypto-jacking botnets has risen in tandem with the popularity and value of cryptocurrencies. Increasingly crypto-mining malware programs are distributed by botnets as they allow threat actors to harness the cumulative processing power of a large number of machines (discussed in our other Darktrace blogs.[1] [2] One of these botnets is Sysrv-hello, which in addition to crypto-mining, propagates aggressively across the Internet in a worm-like manner by trolling for Remote Code Execution (RCE) vulnerabilities and SSH worming from the compromised victim devices. This all has the purpose of expanding the botnet.

First identified in December 2020, Sysrv-hello's operators constantly update and change the bots' behavior to evolve and stay ahead of security researchers and law enforcement. As such, infected systems can easily go unnoticed by both users and organizations. This blog examines the cyber kill chain sequence of a Sysrv-hello botnet infection detected at the network level in Darktrace's Enterprise Immune System, as well as the botnet's tactics, techniques, and procedures (TTPs) in March and April 2022.

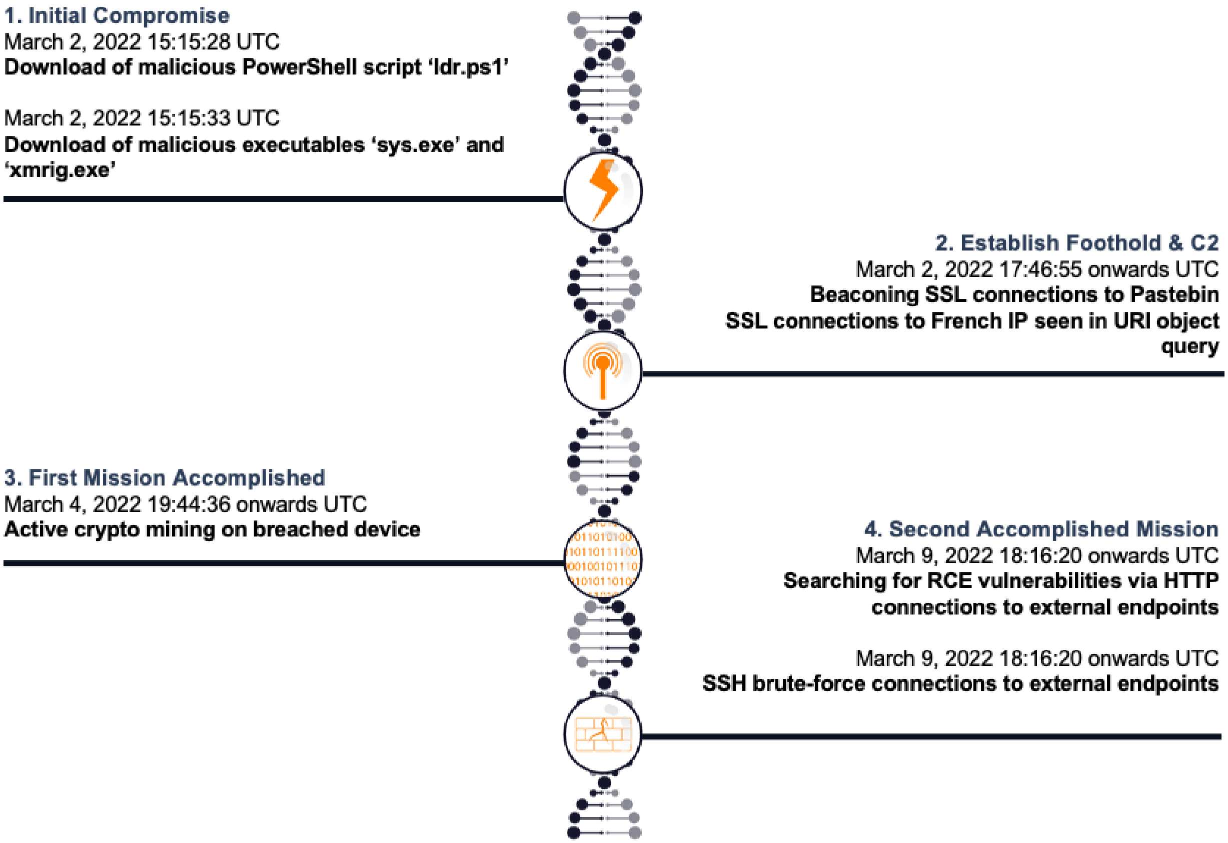

1. Initial Compromise
March 2, 2022 15:15:28 UTC
Download of malicious PowerShell script 'ldr.ps1'
March 2, 2022 15:15:33 UTC
Download of malicious executables 'sys.exe' and 'xmrig.exe'
2. Establish Foothold & C2
March 2, 2022 17:46:55 onwards UTC
Beaconing SSL connections to Pastebin
SSL connections to French IP seen in URI object query
3. First Mission Accomplished
March 4, 2022 19:44:36 onwards UTC
Active crypto mining on breached device
4. Second Accomplished Mission
March 9, 2022 18:16:20 onwards UTC
Searching for RCE vulnerabilities via HTTP connections to external endpoints
March 9, 2022 18:16:20 onwards UTC
SSH brute-force connections to external endpoints

Figure 1: Timeline of the attack

Delivery and exploitation

The organization, which was trialing Darktrace, had deployed the technology on March 2, 2022. On the very same day, the initial host infection was seen through the download of a first-stage PowerShell loader script from a rare external endpoint by a device in the internal network. Although initial exploitation of the device happened prior to the installation and was not observed, this botnet is known to target RCE vulnerabilities in various applications such as MySQL, Tomcat, PHPUnit, Apache Solar, Confluence, Laravel, JBoss, Jira, Sonatype, Oracle WebLogic and Apache Struts to gain initial access to internal systems.[3] Recent iterations have also been reported to have been deployed via drive-by-downloads from an empty HTML iframe pointing to a malicious executable that downloads to the device from a user visiting a compromised website.[4]

Initial intrusion

The Sysrv-hello botnet is distributed for both Linux and Windows environments, with the corresponding compatible script pulled based on the architecture of the system. In this incident, the Windows version was observed.

On March 2, 2022 at 15:15:28 UTC, the device made a successful HTTP GET request to a malicious IP address[5] that had a rarity score of 100% in the network. It subsequently downloaded a malicious PowerShell script named 'ldr.ps1'[6] onto the system. The associated IP address '194.145.227[.]21' belongs to 'ASN AS48693 Rices Privately owned enterprise' and had been identified as a Sysrv-hello botnet command and control (C2) server in April the previous year. [3]

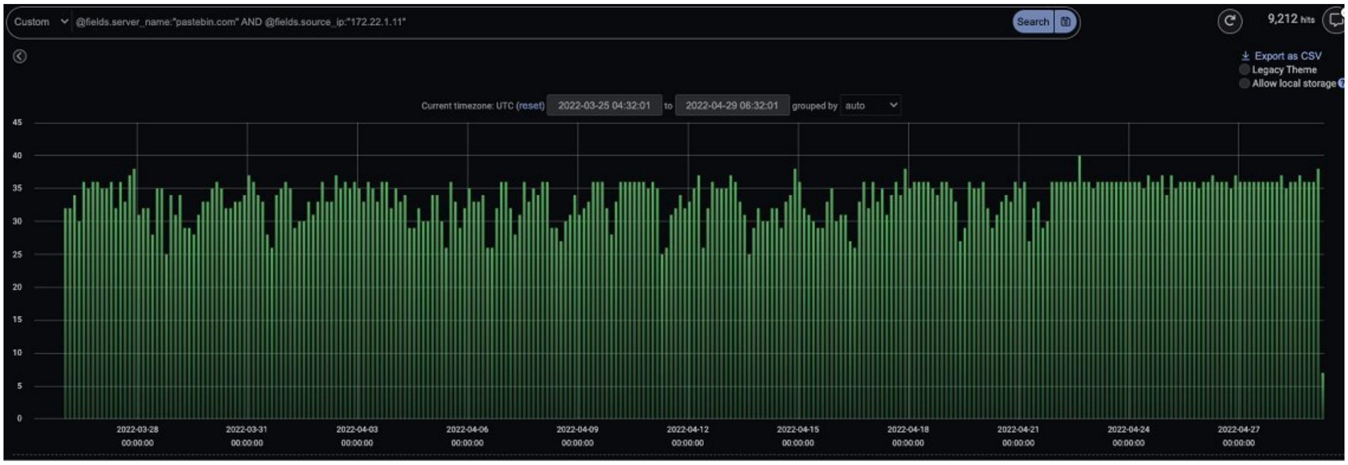
Looking at the URI '/ldr.ps1?b0f895_admin:admin_81.255.222.82:8443_https', it appears some form of query was being executed onto the object. The question mark '?' in this URI is used to delimit the boundary between the URI of the queryable object and the set of strings used to express a query onto that object. Conventionally, we see the set of strings contains a list of key/value pairs with equal signs '=', which are separated by the ampersand symbol '&' between each of those parameters (e.g. www.youtube[.]com/watch?v=RdcCjDS0s6s&ab_channel=SANSCyberDefense), though the exact structure of the query string is not standardized and different servers may parse it differently. Instead, this case saw a set of strings with the hexadecimal color code #b0f895 (a light shade of green), admin username and password login credentials, and the IP address '81.255.222[.]82' being applied during the object query (via HTTPS protocol on port 8443). In recent months this French IP has also had reports of abuse from the OSINT community.[7]

On March 2, 2022 at 15:15:33 UTC, the PowerShell loader script further downloaded second-stage executables named 'sys.exe' and 'xmrig.2 sver.[8] [9] These have been identified as the worm and cryptocurrency miner payloads respectively.

Establish foothold

On March 2, 2022 at 17:46:55 UTC, after the downloads of the worm and cryptocurrency miner payloads, the device initiated multiple SSL connections in a regular, automated manner to Pastebin – a text storage website. This technique was used as a vector to download/upload data and drop further malicious scripts onto the host. OSINT sources suggest the JA3 client SSL fingerprint (05af1f5ca1b87cc9cc9b25185115607d) is associated with PowerShell usage, corroborating with the observation that further tooling was initiated by the PowerShell script 'ldr.ps1'.

Continual Pastebin C2 connections were still being made by the device almost two months since the initiation of such connections. These Pastebin C2 connections point to new tactics and techniques employed by Sysrv-hello — reports earlier than May do not appear to mention any usage of the file storage site. These new TTPs serve two purposes: defense evasion using a web service/protocol and persistence. Persistence was likely achieved through scheduling daemons downloaded from this web service and shellcode executions at set intervals to kill off other malware processes, as similarly seen in other botnets.[10] Recent reports have seen other malware programs also switch to Pastebin C2 tunnels to deliver subsequent payloads, scrapping the need for traditional C2 servers and evading detection.[11]



Custom @fields.server_name:"pastebin.com" AND @fields.source_ip:"172.22.1.11"

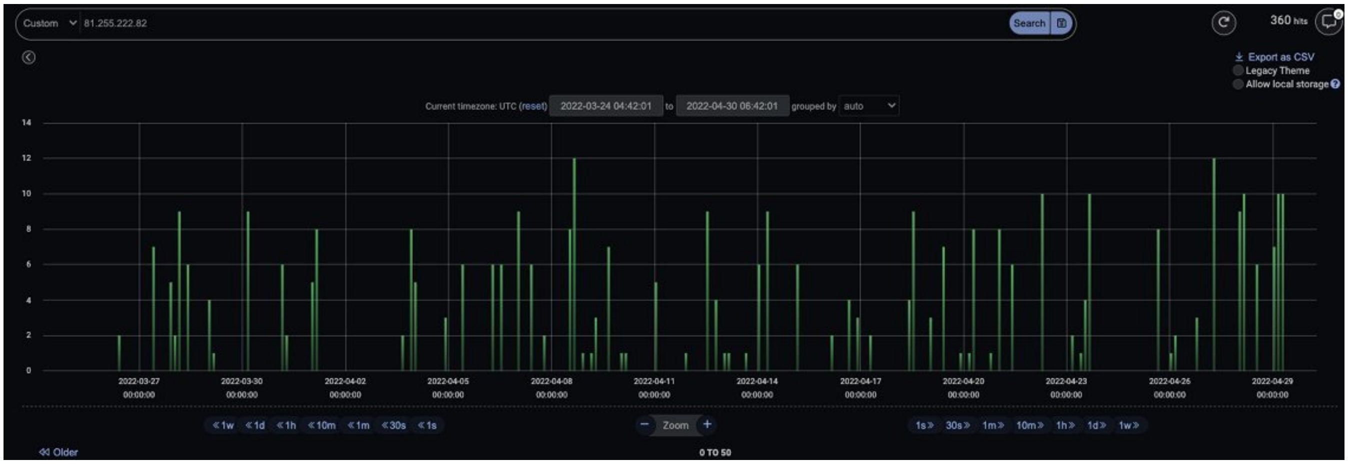
Current timezone: UTC (reset) 2022-03-25 04:32:01 to 2022-04-29 06:32:01 grouped by auto

9,212 hits

Figure 2: A section of the constant SSL connections that the device was still making to ‘pastebin[.]com’ even in the month of April, which resembles beaconing scheduled activity

Throughout the months of March and April, suspicious SSL connections were made from a second potentially compromised device in the internal network to the infected breach device. The suspicious French IP address ‘81.255.222[.]82’ previously seen in the URI object query was revealed as the value of the Server Name Indicator (SNI) in these SSL connections where, typically, a hostname or domain name is indicated.

After an initial compromise, attackers usually aim to gain long-term remote shell access to continue the attack. As the breach device does not have a public IP address and is most certainly behind a firewall, for it to be directly accessible from the Internet a reverse shell would need to be established. Outgoing connections often succeed because firewalls generally filter only incoming traffic. Darktrace observed the device making continuous outgoing connections to an external host listening on an unusual port, 8443, indicating the presence of a reverse shell for pivoting and remote administration.



Custom 81.255.222.82

Current timezone: UTC (reset) 2022-03-24 04:42:01 to 2022-04-30 06:42:01 grouped by auto

360 hits

Figure 3: SSL connections to server name ‘81.255.222[.]8’ at end of March and start of April

Accomplish mission

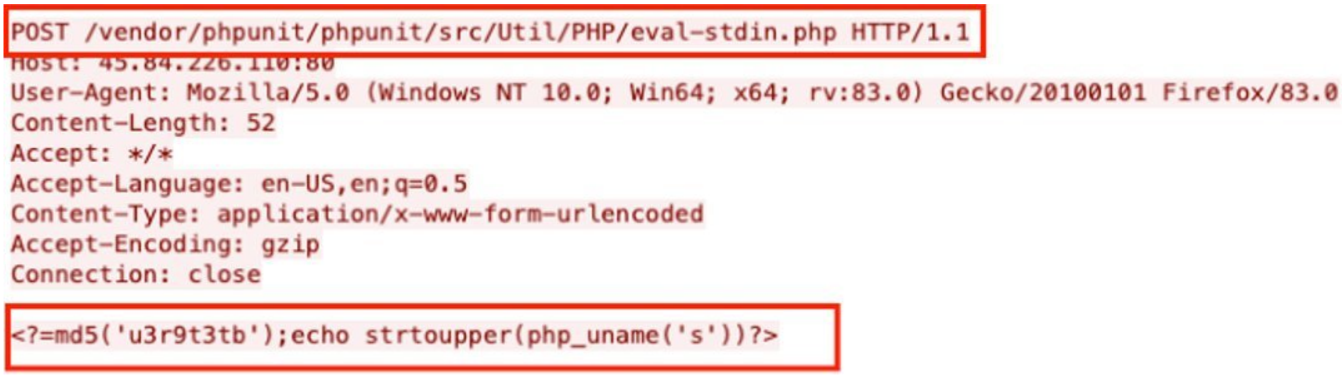
On March 4, 2022 at 15:07:04 UTC, the device made a total of 16,029 failed connections to a large volume of external endpoints on the same port (8080). This behavior is consistent with address scanning. From the country codes, it appears that public IP addresses for various countries around the world were contacted (at least 99 unique addresses), with the US being the most targeted.

From 19:44:36 UTC onwards, the device performed cryptocurrency mining using the Minergate mining pool protocol to generate profits for the attacker. A login credential called ‘x’ was observed in the Minergate connections to ‘194.145.227[.]21’ via port 5443. JSON-RPC methods of ‘login’ and ‘submit’ were seen from the connection originator (the infected breach device) and ‘job’ was seen from the connection responder (the C2 server). A high volume of connections using the JSON-RPC application protocol to ‘pool-fr.supportxmr[.]com’ were also made on port 80.

When the botnet was first discovered in December 2020, mining pools MineXMR and F2Pool were used. In February 2021, MineXMR was removed and in March 2021, Nanopool mining pool was added,[12] before switching to the present SupportXMR and Minergate mining pools. Threat actors utilize such proxy pools to help hide the actual crypto wallet address where the contributions are made by the crypto-mining activity. From April onwards, the device appears to download the ‘xmrig.exe’ executable from a rare IP address ‘61.103.177[.]229’ in Korea every few days – likely in an attempt to establish persistency and ensure the cryptocurrency mining payload continues to exist on the compromised system for continued mining.

On March 9, 2022 from 18:16:20 UTC onwards, trolling for various RCE vulnerabilities (including but not limited to these four) was observed over HTTP connections to public IP addresses:

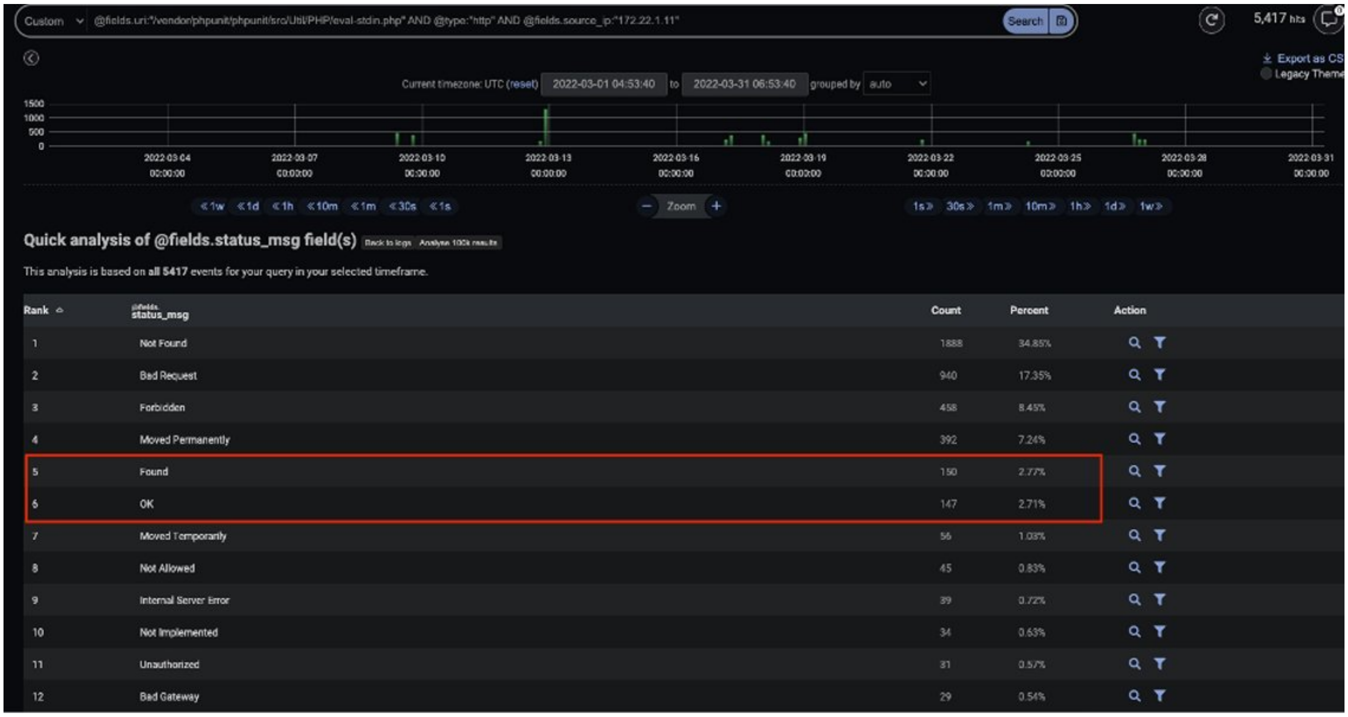
1. Through March, the device made around 5,417 HTTP POSTs with the URI ‘/vendor/phpunit/phpunit/src/Util/PHP/eval-stdin.php’ to at least 99 unique public IPs. This appears to be related to CVE-2017-9841, which in PHPUnit allows remote attackers to execute arbitrary PHP code via HTTP POST data beginning with a ‘[13] PHPUnit is a common testing framework for PHP, used for performing unit tests during application development. It is used by a variety of popular Content Management Systems (CMS) such as WordPress, Drupal and Prestashop. This CVE has been called “one of the most exploitable CVEs of 2019,” with around seven million attack attempts being observed that year.[14] This framework is not designed to be exposed on the critical paths serving web pages and should not be reachable by external HTTP requests. Looking at the status messages of the HTTP POSTs in this incident, some ‘Found’ and ‘OK’ messages were seen, suggesting the vulnerable path could be accessible on some of those endpoints.



```
POST /vendor/phpunit/phpunit/src/Util/PHP/eval-stdin.php HTTP/1.1
Host: 45.84.226.110:80
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:83.0) Gecko/20100101 Firefox/83.0
Content-Length: 52
Accept: */*
Accept-Language: en-US,en;q=0.5
Content-Type: application/x-www-form-urlencoded
Accept-Encoding: gzip
Connection: close

<?=md5('u3r9t3tb');echo strtoupper(php_uname('s'))?>
```

Figure 4: PCAP of CVE-2017-9841 vulnerability trolling



@fields.uri:"/vendor/phpunit/phpunit/src/Util/PHP/eval-stdin.php" AND @type:"http" AND @fields.source_ip:"172.22.1.11"

Current timezone: UTC (reset) 2022-03-01 04:53:40 to 2022-03-31 06:53:40 grouped by auto

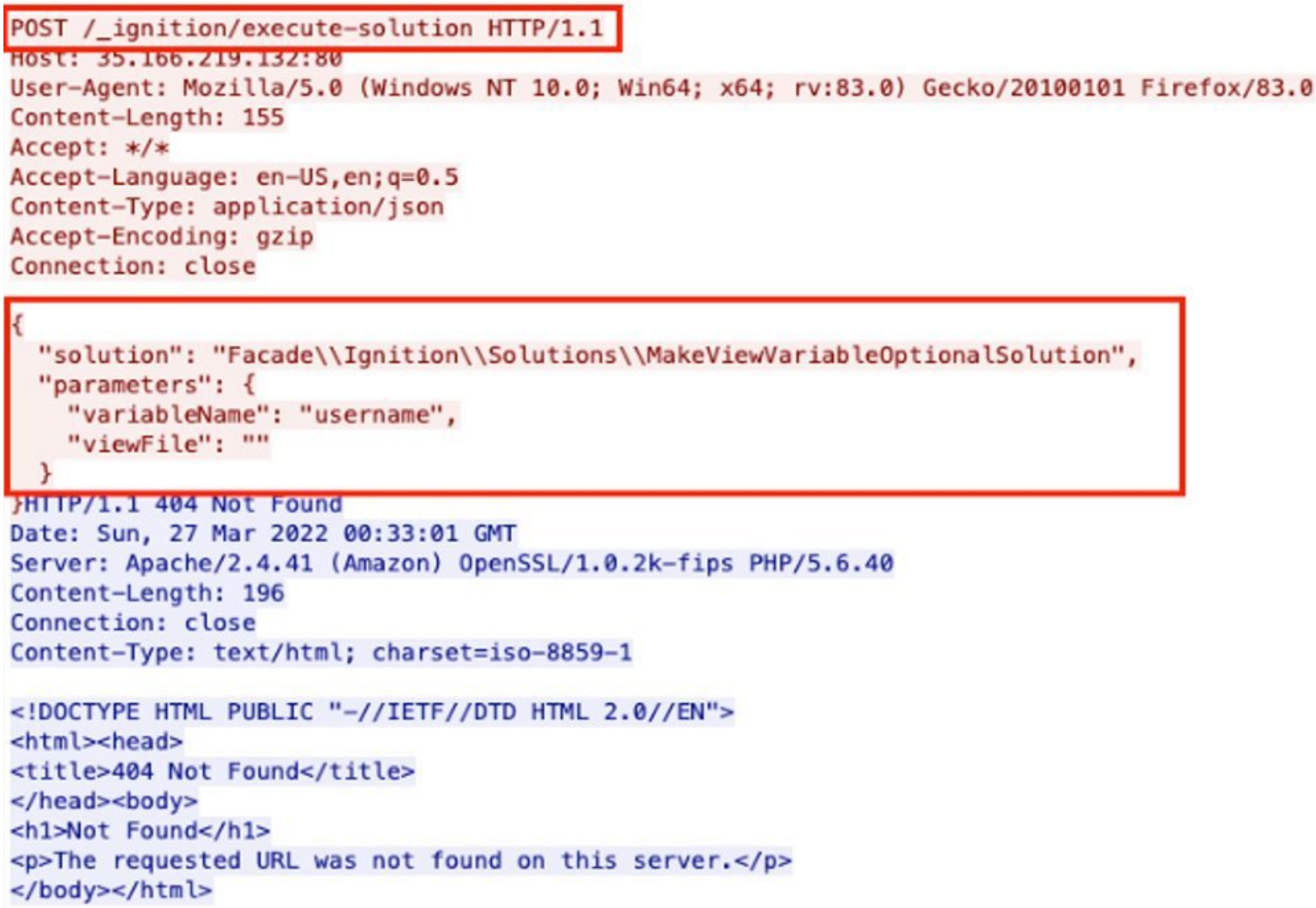
Quick analysis of @fields.status_msg field(s)

This analysis is based on **all 5417** events for your query in your selected timeframe.

Rank	@fields. status_msg	Count	Percent	Action
1	Not Found	1888	34.85%	🔍 ▼
2	Bad Request	940	17.35%	🔍 ▼
3	Forbidden	458	8.45%	🔍 ▼
4	Moved Permanently	392	7.24%	🔍 ▼
5	Found	150	2.77%	🔍 ▼
6	OK	147	2.71%	🔍 ▼
7	Moved Temporarily	56	1.03%	🔍 ▼
8	Not Allowed	45	0.83%	🔍 ▼
9	Internal Server Error	39	0.72%	🔍 ▼
10	Not Implemented	34	0.63%	🔍 ▼
11	Unauthorized	31	0.57%	🔍 ▼
12	Bad Gateway	29	0.54%	🔍 ▼

Figure 5: The CVE-2017-9841 vulnerable path appears to be reachable on some endpoints

1. Through March, the device also made around 5,500 HTTP POSTs with the URI '/_ignition/execute-solution' to at least 99 unique public IPs. This appears related to CVE-2021-3129, which allows unauthenticated remote attackers to execute arbitrary code using debug mode with Laravel, a PHP web application framework in versions prior to 8.4.2.[15] The POST request below makes the variable 'username' optional, and the 'viewFile' parameter is empty, as a test to see if the endpoint is vulnerable.[16]



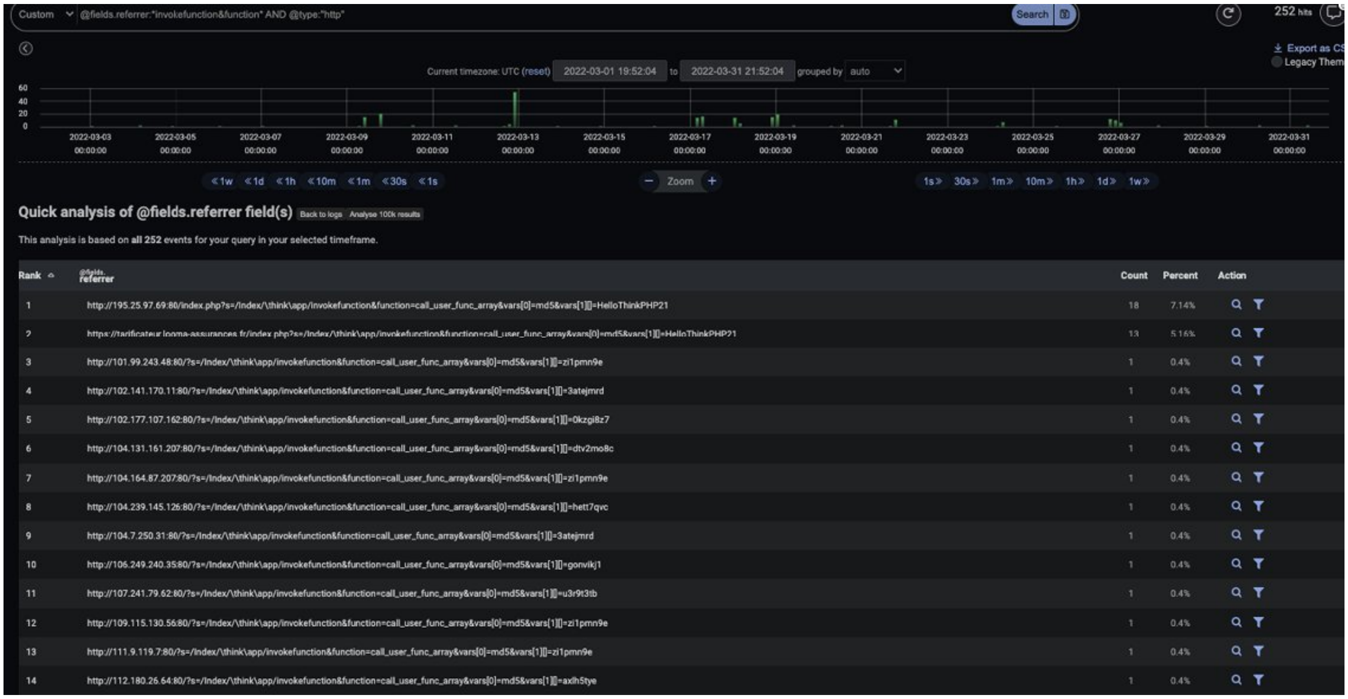
```
POST /_ignition/execute-solution HTTP/1.1
Host: 35.166.219.132:80
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:83.0) Gecko/20100101 Firefox/83.0
Content-Length: 155
Accept: */*
Accept-Language: en-US,en;q=0.5
Content-Type: application/json
Accept-Encoding: gzip
Connection: close

{
  "solution": "Facade\\Ignition\\Solutions\\MakeViewVariableOptionalSolution",
  "parameters": {
    "variableName": "username",
    "viewFile": ""
  }
}HTTP/1.1 404 Not Found
Date: Sun, 27 Mar 2022 00:33:01 GMT
Server: Apache/2.4.41 (Amazon) OpenSSL/1.0.2k-fips PHP/5.6.40
Content-Length: 196
Connection: close
Content-Type: text/html; charset=iso-8859-1

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html><head>
<title>404 Not Found</title>
</head><body>
<h1>Not Found</h1>
<p>The requested URL was not found on this server.</p>
</body></html>
```

Figure 6: PCAP of CVE-2021-3129 vulnerability trolling

1. The device made approximately a further 252 HTTP GETs with URIs containing 'invokefunction&function' to another minimum of 99 unique public IPs. This appears related to a RCE vulnerability in ThinkPHP, an open-source web framework.[17]



@fields.referrer:"invokefunction&function" AND @type:"http"

Current timezone: UTC (reset) 2022-03-01 19:52:04 to 2022-03-31 21:52:04 grouped by auto

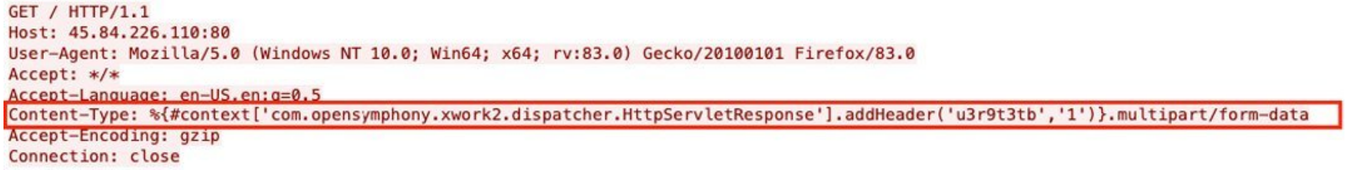
Quick analysis of @fields.referrer field(s)

This analysis is based on **all 252** events for your query in your selected timeframe.

Rank	@fields.referrer	Count	Percent	Action
1	http://195.25.97.69:80/index.php?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=HelloThinkPHP21	18	7.14%	🔍 ▼
2	https://tarificateur.looma-assurances.fr/index.php?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=HelloThinkPHP21	13	5.16%	🔍 ▼
3	http://101.99.243.48:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=zi1pmn9e	1	0.4%	🔍 ▼
4	http://102.141.170.11:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=3atejmrd	1	0.4%	🔍 ▼
5	http://102.177.107.162:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=0kzgi8z7	1	0.4%	🔍 ▼
6	http://104.131.161.207:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=dtv2mo8c	1	0.4%	🔍 ▼
7	http://104.164.87.207:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=zi1pmn9e	1	0.4%	🔍 ▼
8	http://104.239.145.126:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=hett7qvc	1	0.4%	🔍 ▼
9	http://104.7.250.31:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=3atejmrd	1	0.4%	🔍 ▼
10	http://106.249.240.35:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=gonvikj1	1	0.4%	🔍 ▼
11	http://107.241.79.62:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=u3r9t3tb	1	0.4%	🔍 ▼
12	http://109.115.130.56:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=zi1pmn9e	1	0.4%	🔍 ▼
13	http://111.9.119.7:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=zi1pmn9e	1	0.4%	🔍 ▼
14	http://112.180.26.64:80/?s=/Index/\think\app/invokefunction&function=call_user_func_array&vars[0]=md5&vars[1][]=axlh5tye	1	0.4%	🔍 ▼

Figure 7: Some of the URIs associated with ThinkPHP RCE vulnerability

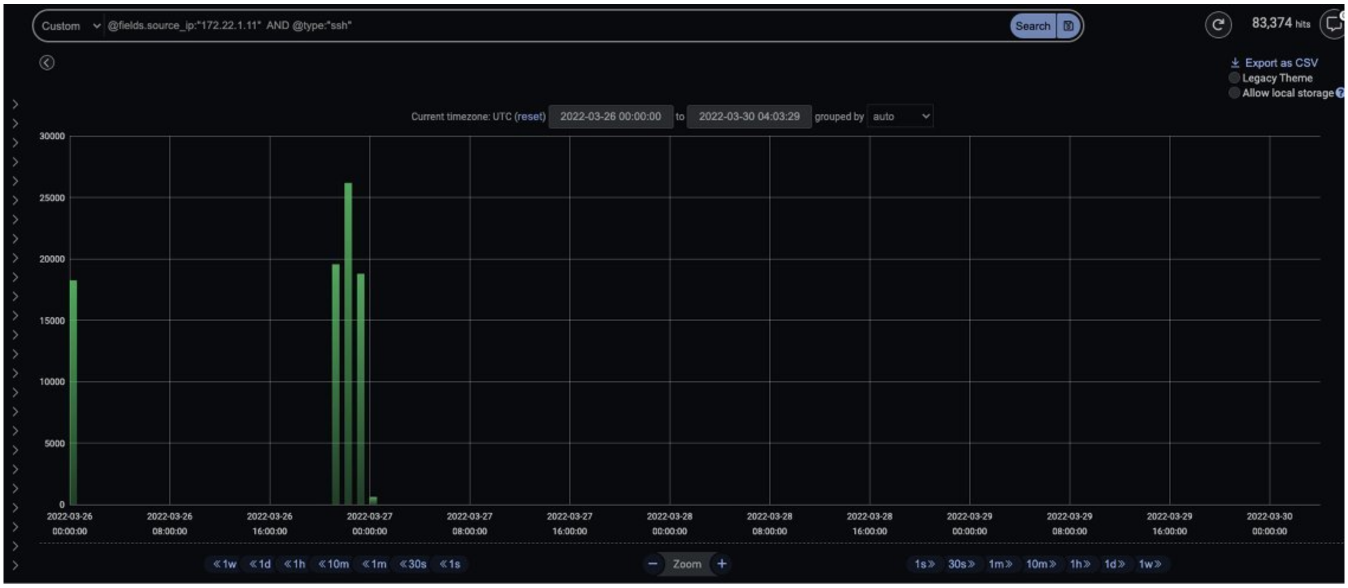
1. A HTTP header related to a RCE vulnerability for the Jakarta Multipart parser used by Apache struts2 in CVE-2017-5638[18] was also seen during the connection attempts. In this case the payload used a custom Content-Type header.



```
GET / HTTP/1.1
Host: 45.84.226.110:80
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:83.0) Gecko/20100101 Firefox/83.0
Accept: */*
Accept-Language: en-US,en;q=0.5
Content-Type: %{#context['com.opensymphony.xwork2.dispatcher.HttpServletResponse'].addHeader('u3r9t3tb','1')}.multipart/form-data
Accept-Encoding: gzip
Connection: close
```

Figure 8: PCAP of CVE-2017-5638 vulnerability trolling

Two widely used methods of SSH authentication are public key authentication and password authentication. After gaining a foothold in the network, previous reports[3] [19] have mentioned that Sysrv-hello harvests private SSH keys from the compromised device, along with identifying known devices. Being a known device means the system can communicate with the other system without any further authentication checks after the initial key exchange. This technique was likely performed in conjunction with password brute-force attacks against the known devices. Starting from March 9, 2022 at 20:31:25 UTC, Darktrace observed the device making a large number of SSH connections and login failures to public IP ranges. For example, between 00:05:41 UTC on March 26 and 05:00:02 UTC on April 14, around 83,389 SSH connection attempts were made to 31 unique public IPs.

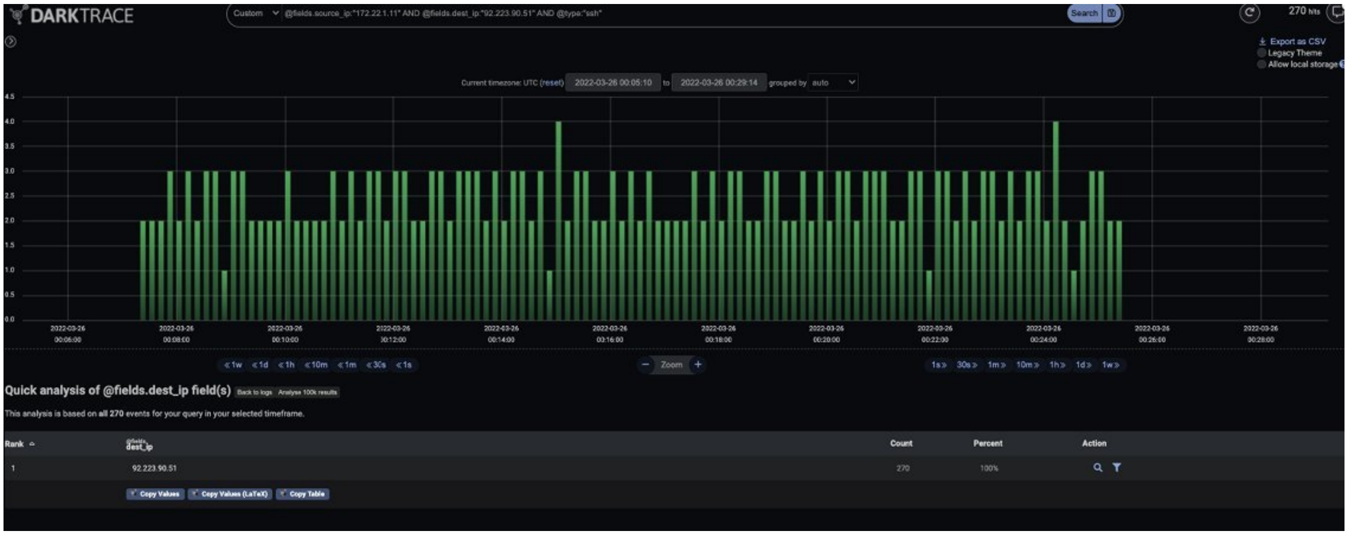


Custom @fields.source_ip:"172.22.1.11" AND @type:"ssh"

83,374 hits

Current timezone: UTC (reset) 2022-03-26 00:00:00 to 2022-03-30 04:03:29 grouped by auto

Figure 9: Darktrace's Threat Visualizer shows large spikes in SSH connections by the breach device



Custom @fields.source_ip:"172.22.1.11" AND @fields.dest_ip:"92.223.90.51" AND @type:"ssh"

270 hits

Current timezone: UTC (reset) 2022-03-26 00:05:10 to 2022-03-26 00:29:14 grouped by auto

Quick analysis of @fields.dest_ip field(s)

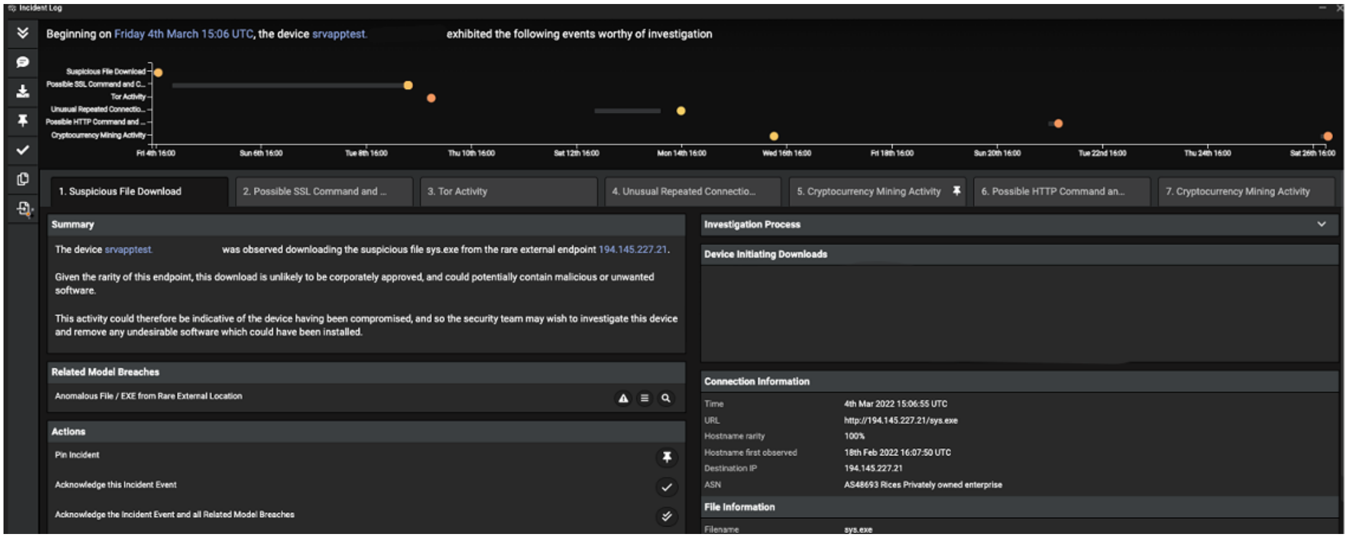
This analysis is based on all 270 events for your query in your selected timeframe.

Rank	@fields.dest_ip	Count	Percent	Action
1	92.223.90.51	270	100%	

Figure 10: Beaconing SSH connections to a single external endpoint, indicating a potential brute-force attack

Darktrace coverage

Cyber AI Analyst was able to connect the events and present them in a digestible, chronological order for the organization. In the aftermath of any security incidents, this is a convenient way for security users to conduct assisted investigations and reduce the workload on human analysts. However, it is good to note that this activity was also easily observed in real time from the model section on the Threat Visualizer due to the large number of escalating model breaches.



Beginning on Friday 4th March 15:06 UTC, the device srvapptest.[redacted] exhibited the following events worthy of investigation

1. Suspicious File Download | 2. Possible SSL Command and ... | 3. Tor Activity | 4. Unusual Repeated Connectio... | 5. Cryptocurrency Mining Activity | 6. Possible HTTP Command an... | 7. Cryptocurrency Mining Activity

Summary

The device srvapptest.[redacted] was observed downloading the suspicious file sys.exe from the rare external endpoint 194.145.227.21.

Given the rarity of this endpoint, this download is unlikely to be corporately approved, and could potentially contain malicious or unwanted software.

This activity could therefore be indicative of the device having been compromised, and so the security team may wish to investigate this device and remove any undesirable software which could have been installed.

Related Model Breaches

Anomalous File / EXE from Rare External Location

Actions

Pin Incident

Acknowledge this Incident Event

Acknowledge the Incident Event and all Related Model Breaches

Investigation Process

Device Initiating Downloads

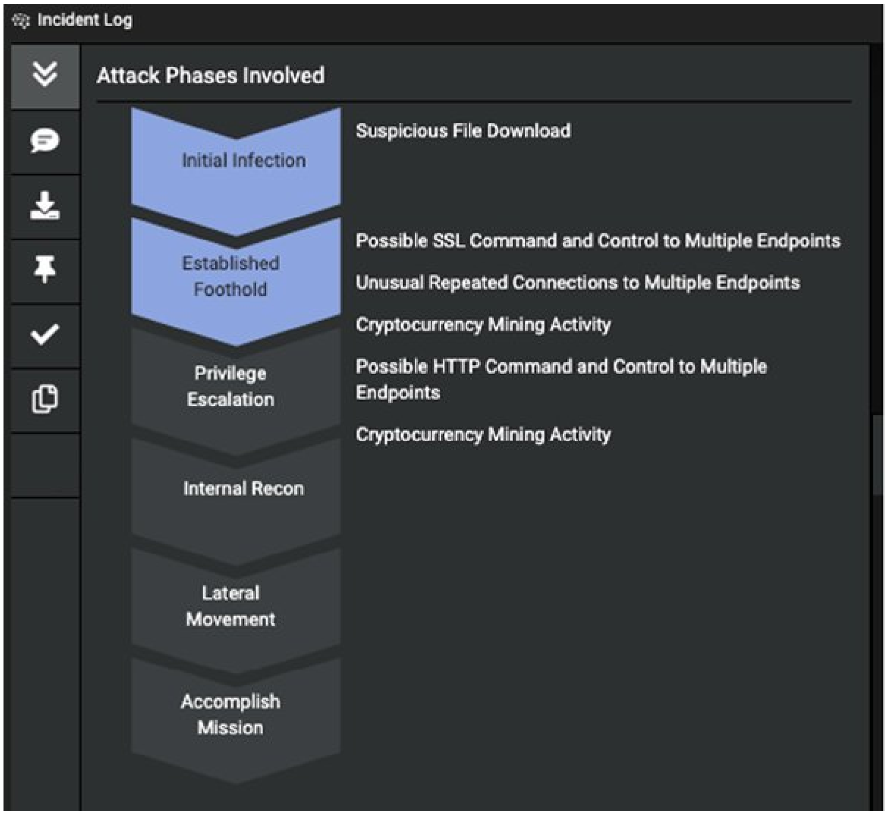
Connection Information

Time	4th Mar 2022 15:06:55 UTC
URL	http://194.145.227.21/sys.exe
Hostname rarity	100%
Hostname first observed	18th Feb 2022 16:07:50 UTC
Destination IP	194.145.227.21
ASN	AS48693 Rices Privately owned enterprise

File Information

Filename	sys.exe

Figure 11: Cyber AI Analyst consolidating the events in the month of March into a summary



Attack Phases Involved

Suspicious File Download

Possible SSL Command and Control to Multiple Endpoints

Unusual Repeated Connections to Multiple Endpoints

Cryptocurrency Mining Activity

Possible HTTP Command and Control to Multiple Endpoints

Cryptocurrency Mining Activity

Figure 12: Cyber AI Analyst shows the progression of the attack through the month of March

As this incident occurred during a trial, Darktrace Antigena was enabled in passive mode – with a valid license to display the actions that it would have taken, but with no active control performed. In this instance, no Antigena models breached for the initial compromised device as it was not tagged to be eligible for Antigena actions. Nonetheless, Darktrace was able to provide visibility into these anomalous connections.

Had Antigena been deployed in active mode, and the breach device appropriately tagged with *Antigena All* or *Antigena External Threat*, Darktrace would have been able to respond and neutralize different stages of the attack through network inhibitors *Block Matching Connections* and *Enforce Group Pattern of Life*, and relevant Antigena models such as *Antigena Suspicious File Block*, *Antigena Suspicious File Pattern of Life Block*, *Antigena Pastebin Block* and *Antigena Crypto Currency Mining Block*. The first of these inhibitors, *Block Matching Connections*, will block the specific connection and all future connections that matches the same criteria (e.g. all future outbound HTTP connections from the breach device to destination port 80) for a set period of time. *Enforce Group Pattern of Life* allows a device to only make connections and data transfers that it or any of its peer group typically make.

Conclusion

Resource hijacking results in unauthorized consumption of system resources and monetary loss for affected organizations. Compromised devices can potentially be rented out to other threat actors and botnet operators could switch from conducting crypto-mining to other more destructive illicit activities (e.g. DDoS or dropping of ransomware) whilst changing their TTPs in the future. Defenders are constantly playing catch-up to this continual evolution, and retrospective rules and signatures solutions or threat intelligence that relies on humans to spot future threats will not be able to keep up.

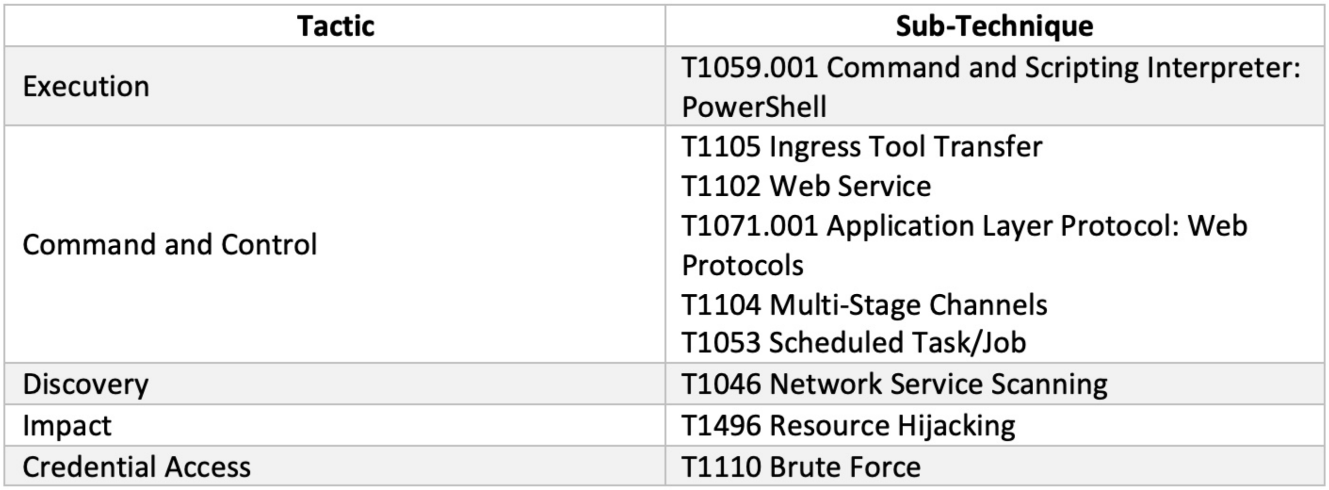
In this case, it appears the botnet operator has added an object query in the URL of the initial PowerShell loader script download, added Pastebin C2 for evasion and persistence, and utilized new cryptocurrency mining pools. Despite this, Darktrace's Self-Learning AI was able to identify the threats the moment attackers changed their approach, detecting every step of the attack in the network without relying on known indicators of threat.

Appendix

Darktrace model detections

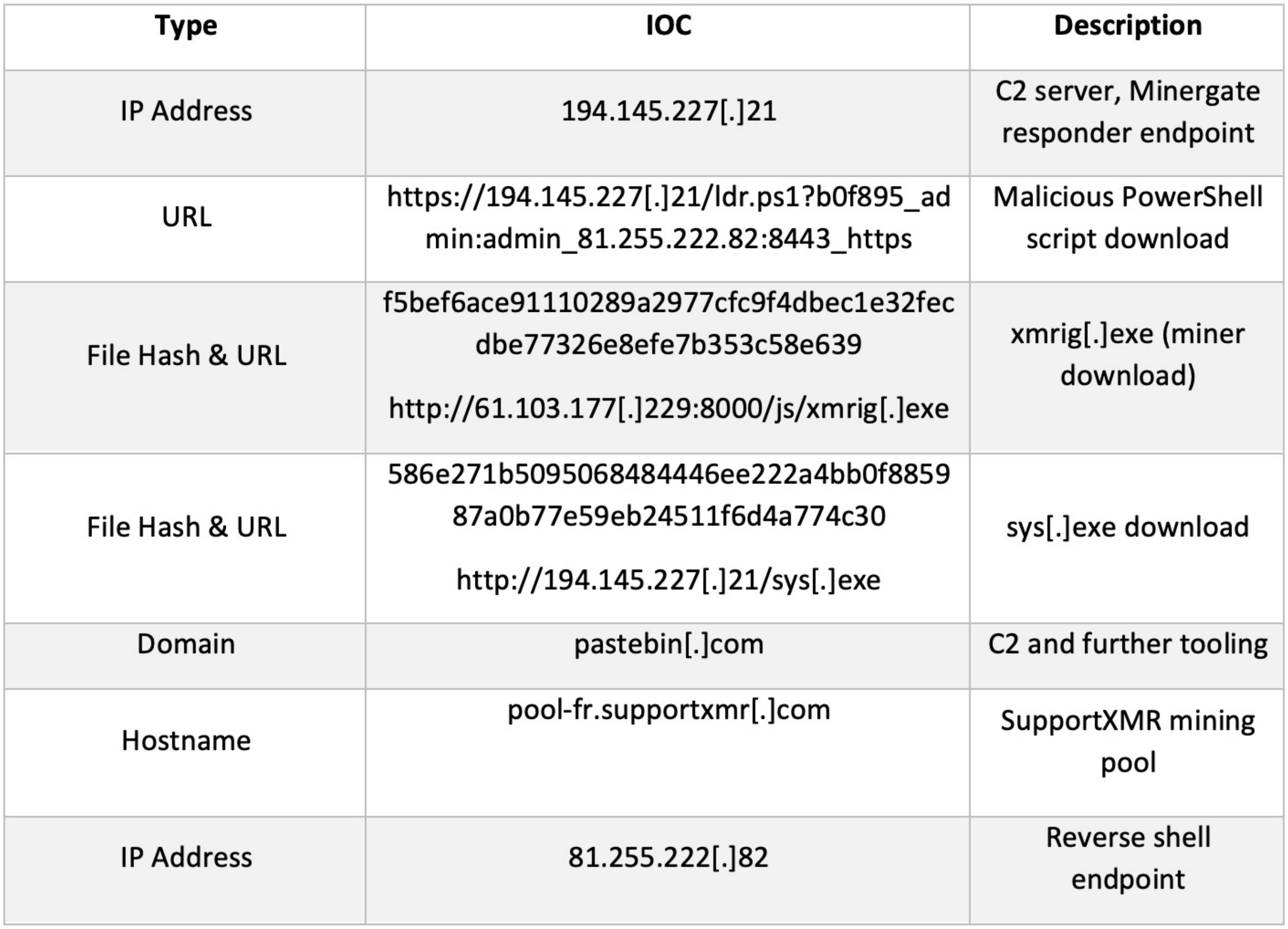
- Anomalous File / Script from Rare Location
- Anomalous File / EXE from Rare External Location
- Compromise / Agent Beacon (Medium Period)
- Compromise / Slow Beaconing Activity To External Rare
- Compromise / Beaconing Activity To External Rare
- Device / External Address Scan
- Compromise / Crypto Currency Mining Activity
- Compromise / High Priority Crypto Currency Mining
- Compromise / High Volume of Connections with Beacon Score
- Compromise / SSL Beaconing to Rare Destination
- Anomalous Connection / Multiple HTTP POSTs to Rare Hostname
- Device / Large Number of Model Breaches
- Anomalous Connection / Multiple Failed Connections to Rare Endpoint
- Anomalous Connection / SSH Brute Force
- Compromise / SSH Beacon
- Compliance / SSH to Rare External AWS
- Compromise / High Frequency SSH Beacon
- Compliance / SSH to Rare External Destination
- Device / Multiple C2 Model Breaches
- Anomalous Connection / POST to PHP on New External Host

MITRE ATT&CK techniques observed:



Tactic	Sub-Technique
Execution	T1059.001 Command and Scripting Interpreter: PowerShell
Command and Control	T1105 Ingress Tool Transfer T1102 Web Service T1071.001 Application Layer Protocol: Web Protocols T1104 Multi-Stage Channels T1053 Scheduled Task/Job
Discovery	T1046 Network Service Scanning
Impact	T1496 Resource Hijacking
Credential Access	T1110 Brute Force

IoCs



Type	IOC	Description
IP Address	194.145.227[.]21	C2 server, Minergate responder endpoint
URL	https://194.145.227[.]21/ldr.ps1?b0f895_admin:admin_81.255.222.82:8443_https	Malicious PowerShell script download
File Hash & URL	f5bef6ace91110289a2977cfc9f4dbec1e32fecdbe77326e8efe7b353c58e639 http://61.103.177[.]229:8000/js/xmrig[.]exe	xmrig[.]exe (miner download)
File Hash & URL	586e271b5095068484446ee222a4bb0f885987a0b77e59eb24511f6d4a774c30 http://194.145.227[.]21/sys[.]exe	sys[.]exe download
Domain	pastebin[.]com	C2 and further tooling
Hostname	pool-fr.supportxmr[.]com	SupportXMR mining pool
IP Address	81.255.222[.]82	Reverse shell endpoint

Thanks to Victoria Baldie and Yung Ju Chua for their contributions.

Footnotes

1. https://www.darktrace.com/en/blog/crypto-botnets-moving-laterally

2. https://www.darktrace.com/en/blog/how-ai-uncovered-outlaws-secret-crypto-mining-operation

3. https://www.lacework.com/blog/sysrv-hello-expands-infrastructure

4. https://www.riskiq.com/blog/external-threat-management/sysrv-hello-cryptojacking-botnet

5. https://www.virustotal.com/gui/ip-address/194.145.227.21

6. https://www.virustotal.com/gui/url/c586845daa2aec275453659f287dcb302921321e04cb476b0d98d731d57c4e83?nocache=1

7. https://www.abuseipdb.com/check/81.255.222.82

8. https://www.virustotal.com/gui/file/586e271b5095068484446ee222a4bb0f885987a0b77e59eb24511f6d4a774c30

9. https://www.virustotal.com/gui/file/f5bef6ace91110289a2977cfc9f4dbec1e32fecdbe77326e8efe7b353c58e639

10. https://www.ironnet.com/blog/continued-exploitation-of-cve-2021-26084

11. https://www.zdnet.com/article/njrat-trojan-operators-are-now-using-pastebin-as-alternative-to-central-command-server

12. https://blogs.juniper.net/en-us/threat-research/sysrv-botnet-expands-and-gains-persistence

13. https://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2017-9841

14. https://www.imperva.com/blog/the-resurrection-of-phpunit-rce-vulnerability

15. https://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2021-3129

16. https://isc.sans.edu/forums/diary/Laravel+v842+exploit+attempts+for+CVE20213129+debug+mode+Remote+code+execution/27758

17. https://securitynews.sonicwall.com/xmlpost/thinkphp-remote-code-execution-rce-bug-is-actively-being-exploited

18. https://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2017-5638

19. https://sysdig.com/blog/crypto-sysrv-hello-wordpress